ZooKeys 37: 1–12 (2010)
doi: 10.3897/zookeys.37.301
www.pensoftonline.net/zookeys

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

A new species of the genus *Mesobuthus* Vachon, 1950 (Scorpiones, Buthidae) from Xinjiang, China

Dong Sun†, Mingsheng Zhu‡

College of life science, Hebei University, Baoding, Hebei Province, 071002, China

† *urn:lsid:zoobank.org:author:AEDD16A3-BECC-45A3-B32B-2473C8DA6EA0*
‡ *urn:lsid:zoobank.org:author:5EE617B1-115E-49BF-92B9-6F5B71CE2A95*

Corresponding author: *Mingsheng Zhu* (mingshengzhu@263.net)

Academic editor: *Wilson Lourenco* | Received 17 October 2009 | Accepted 21 December 2009 | Published 25 February 2010

urn:lsid:zoobank.org:pub:ECDF3A76-08D3-4647-B1BE-41168AF52456

Citation: Sun D, Zhu M (2010) A new species of the genus *Mesobuthus* Vachon, 1950 (Scorpiones, Buthidae) from Xinjiang, China. ZooKeys 37: 1–12. doi: 10.3897/zookeys.37.301

Abstract

A new species of the genus *Mesobuthus* Vachon, 1950 is described, based on specimens collected in the northern piedmont of the Tianshan Mountains, Xinjiang. It is characterized by a slender chela, general coloration yellow to pale brownish-yellow, elongate aculeus and 2–4 markedly large and moderately extroversive lobed granules of the ventrolateral carinae of metasoma segment V. With the description of this new species, the number of known Chinese species of *Mesobuthus* is raised to five.

Keywords

Buthidae, *Mesobuthus*, new species, Xinjiang, China

Introduction

The genus *Mesobuthus* Vachon, 1950 currently includes 12 species (Fet and Lowe 2000; Gantenbein et al. 2000; Lourenço et al. 2005; Kovařík 2007), and it is widespread in the Palearctic region, from Balkans to China and Korea Peninsula. It is distributed in different habitats, but especially in the arid deserts, from Gobi to Central Asia and to Northwest China and Mongolia. The first species of *Mesobuthus* described from

Copyright *D. Sun, M. Zhu*. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

China was *Mesobuthus martensii martensii* by Karsch (1879), originally described in the genus *Buthus* as *Buthus martensii*. After the description of *M. martensii martensii* two other species, *Mesobuthus caucasicus przewalskii* and *Mesobuthus eupeus mongolicus* were described by Birula (1897, 1911). Moreover, Birula (1904) also described a new subspecies, *Mesobuthus martensii hainanensis*, based on one specimen of unknown sex, and labeled from Hainan Island. This subspecies remains, however, of dubious validity mainly because it was never found again in the Island of Hainan or from adjacent areas, but also because no species of *Mesobuthus* was ever found inhabiting evergreen rain forest. *Mesobuthus eupeus thersites* and *Mesobuthus caucasicus intermedius* have also been recorded from China (Fet 1994; Fet and Lowe, 2000). More recently, Lourenço et al. (2005) described the fourth species of this genus from China, *Mesobuthus songi*, based on old preserved specimens from the northern piedmont of Himalayas, Xizang (Tibet).

In comparison with scorpion faunas in adjacent regions (e. g. Vachon 1958; Tikader and Bastawade 1983; Fet 1989), the diversity of scorpions in Xinjiang appear to be rather poor. Having in account that this region of China remained inaccessible during the past several decades and considering its very important surface, it is quite possible that this fauna has been largely underestimated. In fact, scorpion taxonomy and biogeography in China remains yet a considerably poorly known subject of study, and this until very recently (Zhu et al. 2004). All studies in Xinjiang were done by foreign experts (Birula, 1897, 1904, 1911, 1917; Schenkel, 1936). Since then, no other experts have been involved in the study of Xinjiang scorpions. As a part of a research project on the entire Chinese scorpion fauna, a research team is conducting field work in Xinjiang. Among the scorpions found in the region, there are several specimens of *Mesobuthus*, which were collected in the northern piedmont of the Tianshan Mountains and correspond to a distinct new species. It represents the fifth known species of this genus from China.

Material and methods

Specimens were examined and measured under a Leica M165c stereomicroscope with an ocular micrometer. Illustrations were produced using a Leica M165c stereomicroscope with a drawing tube. All measurements follow Stahnke (1970) and are given in millimetres (mm), except for the chela (Vachon, 1952). Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Specimens used in this taxonomic work come from the Museum of Hebei University, Baoding (MHBU) and the American Museum of Natural History, New York (AMNH).

Taxonomy

Family Buthidae C. L. Koch, 1837
Genus *Mesobuthus* Vachon, 1950

***Mesobuthus caucasicus intermedius* (Birula, 1897)**
Figs 2, 11–13

Buthus caucasicus forma γ *intermedia* Birula, 1897: 387.
Mesobuthus caucasicus intermedius: Vachon, 1958: 150, Fig. 31.
Olivierus caucasicus intermedius: Farzanpay, 1987: 156.

Material examined. Type material not examined. Kazakhstan: Almaty Area, Kurty District, Taukum Desert, 25.5 km SE of Topar, 44°53.002'N, 75°17.138'E, 373 m alt., 9/V/2003, L. Prendini & A. V. Gromov leg., 4 females and 3 males (AMNH); South Kazakhstan Area, Chardara District, 3 km W of Chardara, 41°16.106'N, 67°53.228'E, 287 m alt., 20/VI/2003, L. Prendini & A. V. Gromov leg., 1 female and 3 males (AMNH).

Diagnosis. *Coloration*. Basically brownish-yellow; all carinae and posterior edges of carapace and tergites with blackish-brown to black pigments; dorsal surfaces of segments I–IV on metasoma and each surface of segment V with irregular netlike dark pigments. Pedipalps: brownish-yellow; femur and patella with dark pigments, especially around carinae; manus with irregular netlike dark pigments; rows of granules on dentate margins of the fingers blackish-brown. Legs: pale yellow to yellow; tip of femur and base of patella with some dark spots.

Morphology. Total length 66–77 mm in females and 55–60 mm in males. Prosoma: anterior margin with a weak median concavity, not serrate; all carinae moderately strong, granular, and granules moderately developed; Mesosoma: Tergite: I to VI tricarinate; carinae on I weak, and carinae on II–VI moderately to strong, granular; the intercarinal surfaces relatively smooth, except for the segments I–III with sparse and fine granules; exterior surfaces coarsely granular. Pectinal teeth number 20–25 in females and 26–30 in males. Metasoma: Segments I–V with 10-8-8-8-5 complete carinae; median lateral carinae complete on segment I, only with sparse granules and covered 1/3 length of segment on II, and obsolete, remaining 1–3 granules at distal end on III; ventrolateral carinae on segment V strong, serrate, becoming stronger gradually from anterior to posterior; lateral surfaces smooth, dorsal with some fine granules and ventral with sparse large granules. Aculeus longer than a half of telson length. Pedipalps: Trichobothrial pattern: Orthobothriotaxic A-β (Vachon, 1974, 1975). Dentate margins of movable and fixed fingers with 12 and 11 oblique rows of granules respectively; outer accessory denticles becoming smaller from base to tip markedly, and obviously smaller than inner accessory denticles on the tip. Legs: Tarsus ventrally with two moderate to long longitudinal rows of setae.

Distribution. China (Xinjiang Uygur Autonomous Region), Iran (northwest), Kazakstan, Kirghizstan, Tajikistan, Turkmenistan, Uzbekistan (Fet and Lowe, 2000).

Note. Although our field works in Xinjiang are going along in past four years, and we got a large amount of specimens, we could not find any evidence to support the distribution of *Mesobuthus caucasicus intermedius* in China. But here, we decide to refer to Fet and Lowe (2000) before our completing the investigations.

Mesobuthus caucasicus przewalskii (Birula, 1897)

Figs 3, 14–16

Buthus caucasicus przewalskii Birula, 1897: 387–388.
Buthus przewalskii: Kishida, 1939: 44.
Mesobuthus caucasicus intermedius: Vachon, 1958: 150, Fig. 31.
Olivierus caucasicus intermedius: Farzanpay, 1987: 156.

Material examined. Type material not examined. China: Xinjiang Uygur Autonomous Region: Tuokexun County, Xia Village, 4/VIII/2008, M. S. Zhu & D. Sun leg., 9 females, 6 males and 10 juveniles (MHBU); Turpan City, near the Flaming Mountain scenic spot, 4/VIII/2008, M. S. Zhu & D. Sun leg., 1 female, 1 male (MHBU); Shanshan County, Lianmuqin Town, Vineyard, 4/VIII/2008, M. S. Zhu & D. Sun leg., 3 males (MHBU); Hami City, 10 km S of downtown area, Huayuan Village, 2/VIII/2008, M. S. Zhu & D. Sun leg., 6 females, 1 male (MHBU); Hami City, 5 km E of downtown area, under stover in a village, 1/VIII/2008, M. S. Zhu & D. Sun leg., 1 juvenile (MHBU); Shanshan County, 18 km E of country town, 3/VIII/2008, M. S. Zhu & D. Sun leg., 2 juveniles (MHBU); Shanshan County, 4 km W of county town, Vineyard, 3/VIII/2008, M. S. Zhu & D. Sun leg., 2 females (MHBU); Korla City, near the downtown area, 12/IV/2008, C. L. Zhang leg., 1 female, 1 male, 1 juvenile (MHBU); Luntai County, in the *Populus euphratica* Forest Park, 12/VIII/2006, F. Zhang & H. X. Ma leg., 8 females, 6 males (MHBU); Ruoqiang County, near the county town, 30/VII/2006, F. Zhang & H. X. Ma leg., 5 females, 4 males, 1 juvenile (MHBU); Qiemo County, near the county town, 1/VIII/2006, F. Zhang & H. X. Ma leg., 1 female, (MHBU); Turpan City, 7.5 km SW of the downtown area, Vineyard, 8/VIII/2007, D. Sun & L. Zhang leg., 3 females, 22 juveniles (MHBU); Turpan City, near the Flaming Mountain scenic spot, 27/VII/2006, F. Zhang & H. X. Ma leg., 1 female, 1 male (MHBU); Tuokexun County, Xia Village, 6/VIII/2007, D. Sun & L. Zhang leg., 33 females, 18 males, 10 juveniles (MHBU); Kuqa County, near the county town, 11/VIII/2006, F. Zhang & H. X. Ma leg., 1 female, 1 male (MHBU); Luntai County, Lunnan Town, near the Tarim River Bridge, 27/V/2009, D. Sun & Y. W. Zhao leg., 1 female, 1 male (MHBU); Kuqa County, Tarim Village, the Second Brigade site, 31/V/2009, D. Sun & Y. W. Zhao leg., 5 females, 2 males (MHBU); Hami City, Xiheba site in the downtown area, 5/V/2009, D. Sun & Y. W. Zhao leg., 7 females, 6 males (MHBU).

Diagnosis. Coloration. Basically brownish-yellow; all carinae and posterior edges of carapace and tergites with blackish-brown to black pigments; dorsal surfaces of segments I–V on metasoma and ventral surface of segment V with irregular netlike dark pigments. Pedipalps: brownish-yellow; femur and patella with dark pigments, especially around carinae; manus with irregular netlike dark pigments; fingers without pigment, rows of granules on dentate margins of the fingers blackish-brown. Legs: pale yellow to yellow; tip of femur with some dark spots.

Morphology. Total length 68–78 mm in females and 50–68 mm in males. Prosoma: anterior margin with a weak median convexity, finely serrate; all carinae strong, granular and granules markedly biggish; Mesosoma: Tergite: I to VI tricarinate; all carinae strong, granular, except the median carina on I, weak; the intercarinal surfaces relatively smooth, except for the segments I–III with sparse and fine granules; exterior surfaces coarsely granular. Pectinal teeth number 15–19 in females and 19–23 in males. Metasoma: Segments I–V with 10-8-8-8-5 complete carinae; median lateral carinae complete on segment I, only with sparse granules and covered 1/2 length of segment on II and 1/3 on III; ventrolateral carinae strong, serrate, becoming stronger gradually from anterior to posterior; lateral and dorsal surfaces with some fine granules and ventral with sparse large granules. Aculeus about equal to a half of telson length. Pedipalps: Orthobothriotaxic A-β (Vachon, 1974, 1975). Manus of chela relatively robust. Dentate margins of movable and fixed fingers with 11 and 10 oblique rows of granules respectively; outer accessory denticles becoming smaller from base to tip, and smaller than inner accessory denticles on the tip. Legs: Tarsus ventrally with two moderate to long longitudinal rows of setae.

Distribution. China (Xinjiang Uygur Autonomous Region), Mongolia, Tajikistan, Uzbekistan (Fet and Lowe, 2000).

Mesobuthus longichelus sp. n.

urn:lsid:zoobank.org:act:701C6466-5B03-46D5-ADD2-42A4EFDACA21

Figs 1, 4–10, 17–21

Type material. Holotype female (MHBU), China: Xinjiang, northern piedmont of the Tianshan Mountains, 10km S of Jinghe County, 44°31'N, 82°54'E, 7 Aug. 2008, M. S. Zhu, F. Zhang, G. X. Han and D. Sun leg.; 1 juvenile female (MHBU) and 1 juvenile male (MHBU) paratypes, all the same as for holotype.

Diagnosis. Species of moderate size, with respect to the genus. General coloration yellow to pale brownish-yellow; ventral and lateral surfaces of metasoma segment V with inconspicuous variegated black pigment. Chela smooth without carinae, long and slender. The metasoma segments elongate; median lateral carinae complete on segment I, only with sparse granules and covered 1/2–2/3 length of segment on II and obsolete, remaining 1–2 granules at distal end on III; ventrolateral carinae of segment V strong, serrate, becoming strongly marked posteriorly and with 2–3 markedly large and extroversive lobed granules; aculeus markedly longer than a half of telson length.

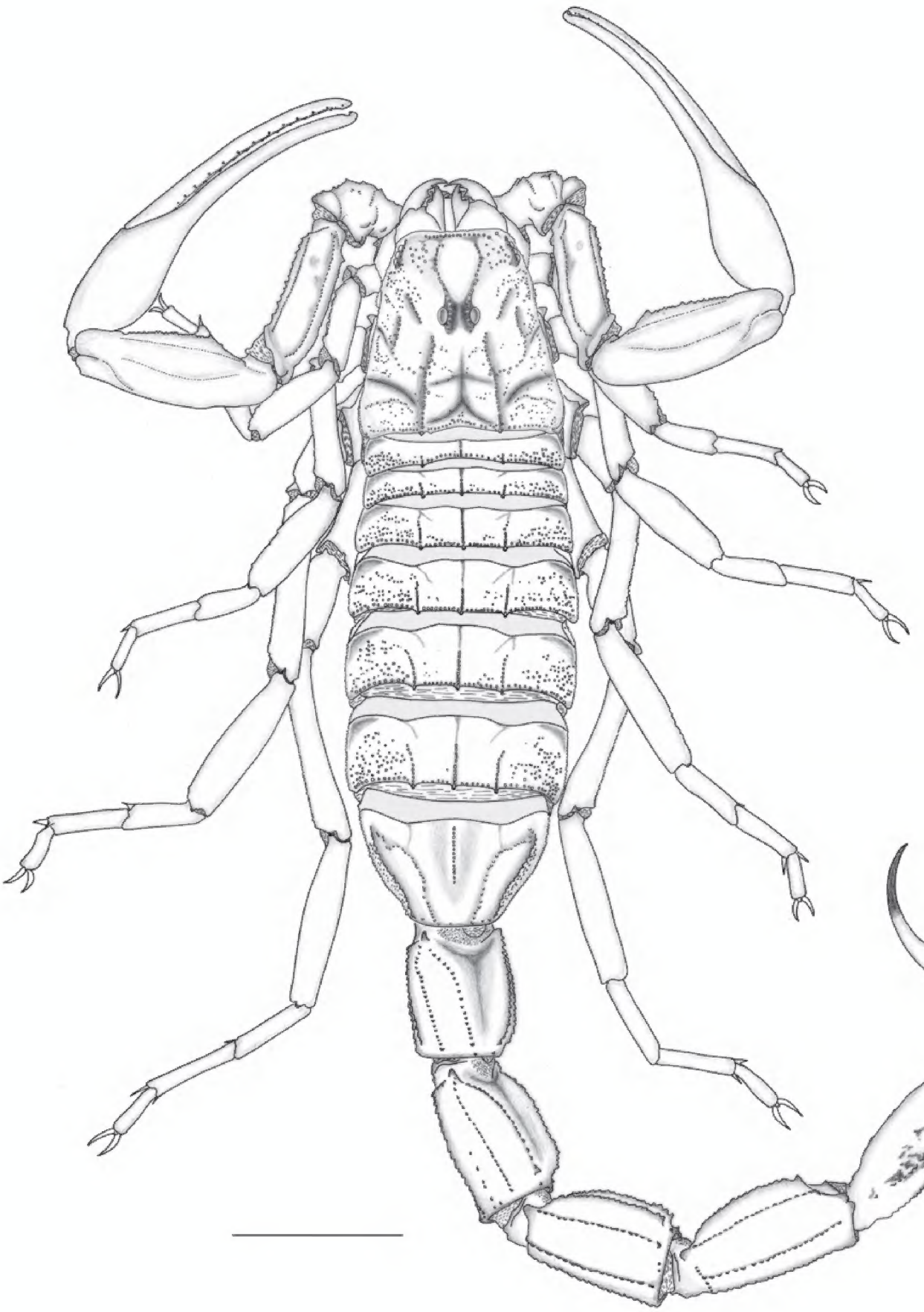
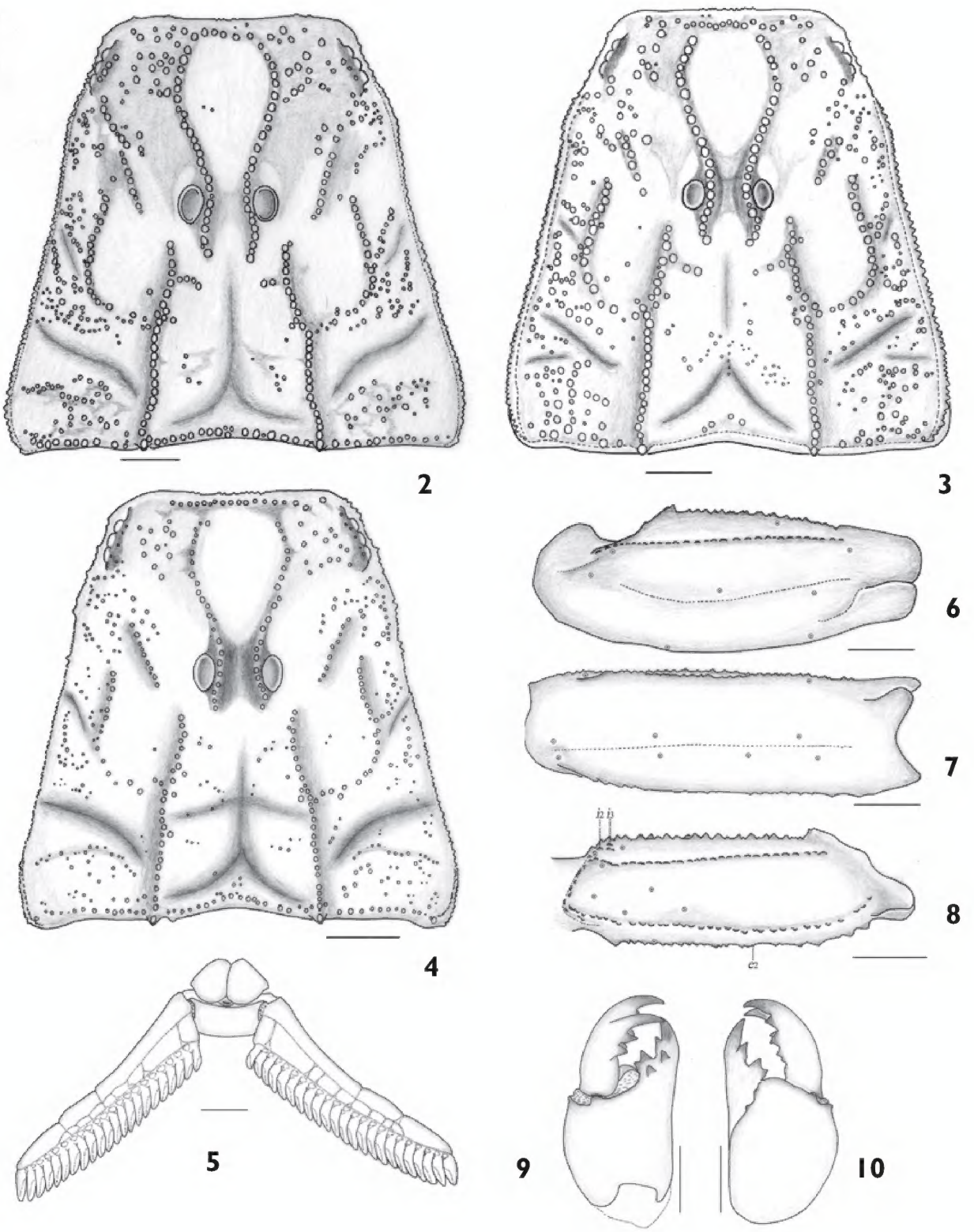


Figure 1. *Mesobuthus longichelus* sp. n. Female holotype. Dorsal view. Scale bar = 5.0 mm.

Dentate margins of movable and fixed fingers with 12 and 11 oblique rows of granules. Pectinal tooth count 22–23 in females and 27–28 in male. *Mesobuthus longichelus* sp. n. is undoubtedly associated with *Mesobuthus caucasicus intermedius* and *Mesobuthus caucasicus przewalskii*, but it can be distinguished by above features, and especially by these three characters: the shape of chela, the median lateral carinae of segment II and III on metasoma, and the shape of ventrolateral carinae of segment V on metasoma.

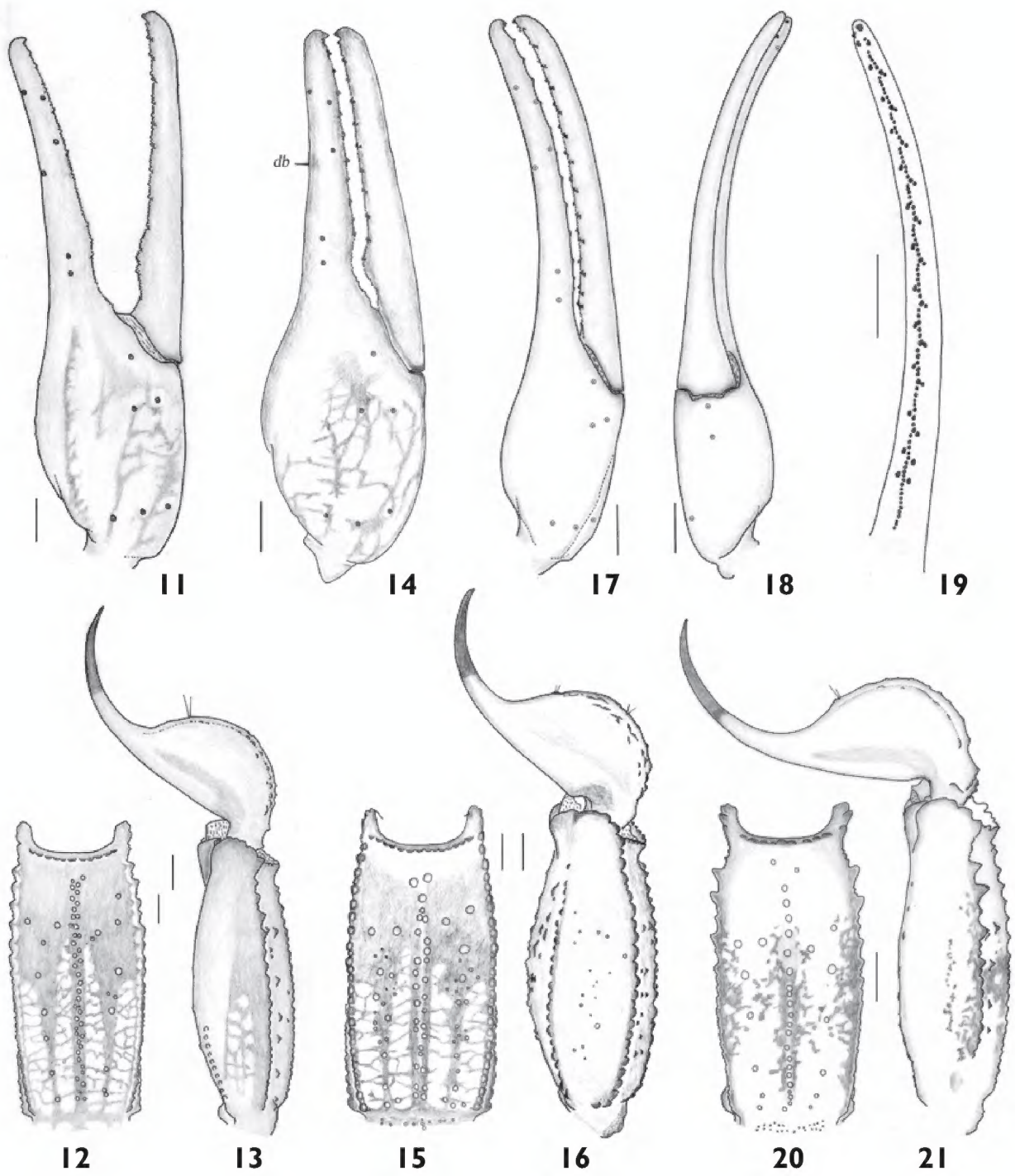


Figures 2–10. 2 *Mesobuthus caucasicus intermedius* (Birula, 1897). Female **3** *Mesobuthus caucasicus przewalskii* (Birula, 1897). Female **4–10** *Mesobuthus longichelus* sp. n. Female holotype. **2–4** Carapace, dorsal aspect **5** Genital operculum and pectines, ventral aspect **6–7** Patella (6. dorsal, 7. external) **8** Femur, dorsal aspect **9–10** Chelicera (9. ventral, 10 dorsal). Scale bar = 1.0mm.

Etymology. The specific name derives from the Latin "*longi* + *chel*", meaning long and chela, referring to the long and slender chela, especially the manus.

Description. Based on female holotype.

Coloration. Basically brownish-yellow. Prosoma: carapace brownish-yellow, with only blackish anterior median carinae, other carinae without pigment; eyes surrounded by black pigment. Mesosoma: brownish-yellow; segments I to VI with a distinct black-



Figures 11–21. 11–13 *Mesobuthus caucasicus intermedius* (Birula, 1897). Female. **14–16** *Mesobuthus caucasicus przewalskii* (Birula, 1897). Female. **17–21** *Mesobuthus longichelus* sp. n. Female holotype. **11, 14, 17** Chela, dorso-external aspect **12, 15, 20** Metasomal segment V, ventral aspect **13, 16, 21** Metasomal segment V and telson, lateral aspect **18** Chela, ventral aspect **19** Disposition of granulations on the dentate margins of the pedipalp chela movable finger, dorsal aspect. Scale bar = 1.0mm.

ish longitudinal stripe in the middle, lateral carinae without pigment. Metasoma: segment I pale brownish-yellow; segments II to V yellow; ventral and lateral surfaces of segment V with inconspicuous variegated black pigment; vesicle yellow and aculeus dark reddish to blackish on its extremity. Venter pale brownish-yellow, except for the pectines which are pale yellow. Chelicerae: pale brownish-yellow without any variegated pigmentation; teeth dark reddish to brownish. Pedipalps: femur, patella and manus

reddish-yellow, without pigment; fingers yellow; rows of granules on dentate margins of the fingers blackish-brown. Legs: pale yellow without pigment.

Morphology. Prosoma: anterior margin with a very weak median concavity; carinae moderately strong, granular and granules relatively minor; central median carinae directly connected with posterior median carinae and lateral median carinae by a row of sparse granules; posterior median carinae terminating distally in a small spinoid process which extends slightly beyond the posterior margin of the carapace; intercarinal surfaces smooth, except for the surfaces between central median carinae and posterior median carinae, which are globally, sparsely and finely granular; the extercarinal surfaces with sparse small granules; the surfaces between anterior median carinae and lateral eyes coarsely granular; furrows moderate. Median ocular tubercle slightly anterior to the centre of carapace; median eyes separated by almost 1.75 ocular diameters; three pairs of lateral eyes.

Mesosoma: Tergite: I to VI tricarinate; lateral carinae on I–VI moderate, granular; the median carina on I weakly, median carinae on II–VI moderate, granular; each carina on I–VI terminating distally in a small spinoid process which extends beyond the posterior margin of tergite, except the median carina on I; the intercarinal surfaces relatively smooth, except for the posterior margins with sparse and fine granules; exterior surfaces moderately to coarsely granular; VII pentacarinate; two pairs of lateral carinae moderate to strong; median carinae present on proximal half, moderate; the intercarinal surfaces smooth. Sternites: III-VII smooth; lateral margins slightly serrate; VII with four weakly marked carinae, granular. Pectines: moderately long; pectinal teeth 22–23 (see variation on table I).

Metasoma: Segments I with 10 complete carinae, segment II–IV with 8 complete carinae; all carinae moderately strong, granular, except the dorsal carinae, serrate; median lateral carinae complete on segment I, only with sparse granules and covered 1/2–2/3 length of segment on II and obsolete, remaining 1–2 granules at distal end on III. Intercarinae surfaces on segments I to IV smooth, except the surfaces between dorsal and dorsolateral carinae on segment I, which are weakly granular. Segment V pentacarinate; ventral carina moderate, granular; ventrolateral carinae strong, serrate, becoming strongly marked posteriorly and with 2–3 markedly large and extroversive lobed granules; dorsolateral carinae weakly developed, obsolete posteriorly; dorsal and lateral surfaces smooth, ventral surface with sparse large granules. Telson smooth dorsally and weakly granular ventrolaterally; aculeus long, markedly more than a half of telson length (see variation on table I).

Chelicerae: Dentition as defined by Vachon (1963) for the family Buthidae.

Pedipalps: Trichobothrial pattern: Orthobothriotaxic A-β (Vachon, 1974, 1975). Femur pentacarinate, moderately to strongly granular; ventrointernal carina with spinoid granules. Patella with seven carinae, very weakly to moderately granular. Intercarinal surfaces on both segments smooth. Chela smooth without carinae; long and slender (table I). Dentate margins of movable and fixed fingers with 12 and 11 oblique rows of granules respectively; outer accessory denticles becoming smaller from base to tip, and smaller than inner accessory denticles on the tip.

Legs: Tarsus ventrally with two long longitudinal rows of setae; tibial spurs present on legs III and IV, moderately marked; pedal spurs present and moderately developed on all legs.

Ecology. The new species was found mainly in habitats composed of very arid and strongly desertified grassland, under very big and oval rocks. This region is constituted by alluvial plains, and is located about 10 km north of the Tianshan Mountains. The area is quite droughty during the whole year, and even during summer. The vegetation is composed of scarcely shrubs, and is strongly xerophytic.

A key to related species

1. Ventrolateral carinae of segment V on metasoma strong, serrate, becoming strongly marked posteriorly and with several markedly large and extroversive lobed granules **2**
– Ventrolateral carinae of segment V on metasoma strong, serrate, becoming gradually stronger posteriorly, and without any markedly large and extroversive lobed granules **3**
2. Ventral carinae of segment II and III on metasoma gradually stronger posteriorly; chela podgy ..... ***Mesobuthus eupeus***
– Ventral carinae of segment II and III on metasoma not stronger posteriorly; chela long and slender ..... ***Mesobuthus longichelus* sp. n.**
3. Dorsal surfaces of segments I–IV on metasoma and each surface of segment V with irregular netlike dark pigments **4**
– Only surfaces of segment V on metasoma with irregular netlike dark pigments, dorsal surfaces of segments I–IV without ..... ***Mesobuthus martensii***
4. Pectinal teeth number 20–25 in females and 26–30 in males; dentate margins of movable and fixed fingers with 12 and 11 oblique rows of granules respectively ..... ***Mesobuthus caucasicus intermedius***
– Pectinal teeth number 15–19 in females and 19–23 in males; dentate margins of movable and fixed fingers with 11 and 10 oblique rows of granules respectively ..... ***Mesobuthus caucasicus przewalskii***

Acknowledgements

We are very grateful to Dr. Wilson. R. Lourenço (France) for reviewing the manuscript. We are also grateful to Dr. Feng Zhang, Dr. Guangxin Han, and Chengli Zhang for their great help and cooperation during the collecting of scorpions, to Dr. Lorenzo Prendini (USA) for loaning specimens, to Prof. Victor Fet (USA), Dr. Daiqin Li (Singapore) and Dr. Xinping Wang (USA) for providing references. This study was supported by grants from the National Natural Science Foundation of China (30670254).

References

Birula AA (1897) Miscellanea scorpiologica. II. Zur Synonymie der russischen Scorpione. Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Pétersbourg 2: 377–391.

Birula AA (1904) Miscellanea scorpiologica. VI. Ueber einige *Buthus*-Arten Centralasiens nebst ihrer geographischen Verbreitung. Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St.-Pétersbourg 9: 20–27.

Birula AA (1911) Arachnologische Beiträge. I. Zur Scorpionen- und Solifugen-Fauna des Chinesischen Reiches. Revue Russe d'Entomologie 11(2): 195–201.

Birula AA (1917) Arachnoidea Arthrogastra Caucasica. Pars I. Scorpiones. Zapiski Kavkazskogo Muzeya (Mémoires du Musée du Caucase). Imprimerie de la Chancellerie du Comité pour la Transcaucasie, Tiflis, 253pp.

Farzanpay R (1987) Knowing scorpions. Central University Publications, Teheran, 1987 (1366), N° 312, Biology 4: 231pp.

Fet V (1989) A catalogue of scorpions (Chelicerata: Scorpiones) of the USSR. Ricista del Museo Civico di Scienze Naturali "Enrico Caffi" (Bergamo) 13(1988): 73–171.

Fet V (1994) Fauna and zoogeography of scorpions (Arachnida: Scorpiones) in Turkmenistan. In: Fet V, Atamuradov KI (Eds), Biogeography and ecology of Turkmenistan (Monographiae Biologicae 72). Kluwer Academic Publishers, Dordrecht, 525–534.

Fet V, Lowe G (2000) Family Buthidae C. L. Koch, 1837. In: Fet V, Sissom WD, Lowe G, Braunwalder ME (Eds), Catalog of the Scorpions of the world (1758-1998). The New York Entomological Society, New York, 54–286.

Gantenbein B, Kropf C, Largiadèr CR, Scholl A (2000) Molecular and morphological evidence for the presence of a new buthid taxon (Scorpiones: Buthidae) on the island of Cyprus. Revue suisse de Zoologie 107(1): 213–232.

Hjelle JT (1990) Anatomy and morphology. In: Polis GA (Ed) The Biology of Scorpions. Stanford University Press, Stanford, 9–63.

Karsch F (1879) Scorpionologische Beiträge. Part II. Mitteilungen des Münchener entomologischen Vereins 3: 97–136.

Kishida K (1939) Arachnida of Jehol. Order Scorpiones. Report of the First Scientific Expedition to Manchoukuo Under the Leadership of Shigeyasu Tokunaga, June-October 1933, Sect. 5, 1(4), Article 10:49–67.

Kovařík F (2007) A revision of the genus *Hottentotta* Birula, 1908, with descriptions of four new species (Scorpiones, Buthidae). Euscorpius 58: 1–107.

Lourenço WR, Qi JX, Zhu MS (2005) Description of two new species of scorpions from China (Tibet) belonging to the genera *Mesobuthus* Vachon (Buthidae) and *Heterometrus* Ehrenberg (Scorpionidae). Zootaxa 985: 1–16.

Schenkel E (1936) Schwedisch-Chinesische wissenschaftliche Expedition nach den nordwestlichen Provizen Chinas unter leitung von Dr. Sven Hedin und Prof. Sü Ping-chang. Scorpione. Arkiv för Zoologi 27a(19): 5.

Stahnke HL (1970) Scorpion nomenclature and mensuration. Entomological News 81: 297–316.

Tikader BK, Bastawade DB (1983) The Fauna of India. Vol. 3. Scorpions (Scorpionida: Arachnida). Zoological Survey of India, Calcutta, 671pp.

Vachon M (1950) Études sur les scorpions. III (Suit). Description des scorpions du nord de l'Afrique. Archives de l'Institut Pasteur d'Algérie 28: 152–216.

Vachon M (1952) Études sur les scorpions. Institut Pasteur d'Algérie, Alger, 482 pp.

Vachon M (1958) Scorpionidea (Chelicerata) de l'Afghanistan. The 3rd Danish Expedition to Central Asia. (Zoological Results 23). Videnskabelige meddelelser fra Dansk naturhistorisk forening i København 120: 121–187.

Vachon M (1963) De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les Scorpions. Bulletin du Muséum national d'Histoire naturelle, Paris 2è sér. 35(2): 161–166.

Vachon M (1974) Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. Bulletin du Muséum national d'Histoire naturelle, Paris, 3è sér. n°140, Zool. 140: 857–958.

Vachon M (1975) Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des Scorpions (Arachnides) dans le classement des genres de la famille des Buthidae Simon. Comptes Rendus de l'Académie des Sciences, Paris, sér. D 281: 1597–1599.

Zhu MS, Qi JX, Song DX (2004) A checklist of scorpions from China (Arachnida: Scorpiones). Acta Arachnologica Sinica 13: 111–118.